

POLAR NIGHT

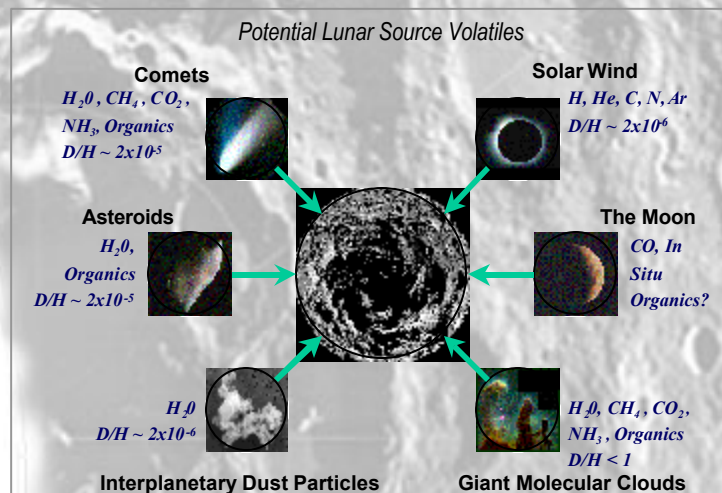
A LUNAR VOLATILES EXPEDITION

MISSION CONCEPT

Polar Night will conduct a comprehensive investigation of the volatile deposits at the poles of the Moon, integrating both in situ and remote sensing measurements. Three probes will be deployed to the surface where they will analyze the composition of the lunar surface materials. The probe landing sites will be selected based on data from the Polar Night orbiter, which will remotely determine the distribution of volatiles within the polar craters.

SCIENCE OBJECTIVE

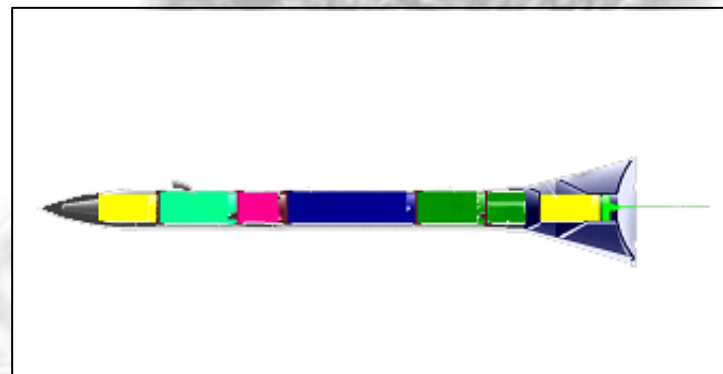
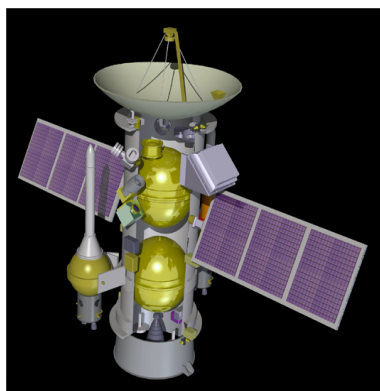
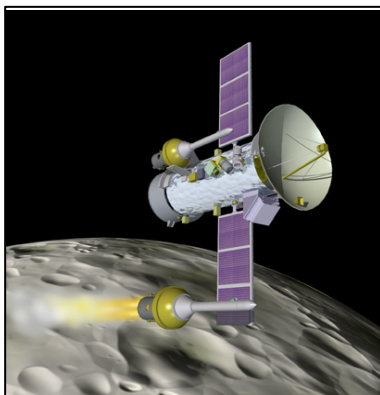
Polar Night's science objective is to identify volatile species and measure their abundances in the lunar cold traps. This includes a chemical and isotopic analysis of any volatiles present and methods for estimating the volume of the deposits. This information will provide the fundamental properties needed to develop a quantitative understanding of the lunar volatile system, including what volatiles can be trapped, the source of the volatiles, the lifetime of the deposits, and evidence for in situ processing of polar volatiles. Polar Night is centrally relevant to the NASA Solar System Exploration theme and the Sun-Earth Connection theme.



SCIENCE PAYLOAD

Instrument	Supplier
<i>Probe Instruments</i>	
Mass Spectrometer	University of Hawaii
Probe Neutron Detector (PND)	Los Alamos National Laboratory
<i>Orbiter Instruments</i>	
Synthetic Aperture Radar (SAR) / Altimeter	Naval Research Laboratory
Imaging Infrared Radiometer (IIRR)	Utah State University Space Dynamics Lab
Imaging Neutron Spectrometer	Los Alamos National Laboratory

Artist Renderings of Spacecraft Configuration and Penetrator



University of Hawaii



Los Alamos
NATIONAL LABORATORY

NATIONAL
GEOGRAPHIC



NRL



Sandia
National
Laboratories

RELATED DISCOVERY MISSIONS

Mission	Polar Night Contribution
Lunar Prospector	PN builds on LP's discovery of hydrogen deposits at the lunar poles by identifying the chemical species responsible for the LP detection of hydrogen.
MESSENGER	Lunar poles are a close analog to the poles of Mercury. PN will finish its mission before MESSENGER arrives at Mercury, so lessons learned from PN may be used in MESSENGER operations. Polar Night's science will be an important complement to data returned from Mercury, as it will directly sample a similar polar environment that Messenger will only sense remotely.
Stardust	PN may also sample volatile components, including organics, of comets or interstellar material. These two data points will give greater insight into the physical properties of comets than either mission could supply alone.
Deep Impact	PN may add complementary data to that of Deep Impact, as the lunar volatile record may contain a more complete volatile inventory than can be obtained from analyzing a single comet.
Genesis	Solar wind deposits sampled by Polar Night will not have been subject to isotopic evolution, because thermal diffusion has not occurred on the lunar surface. PN may also detect evidence of the historical behavior of solar wind, which will complement the current solar wind data collected by Genesis.

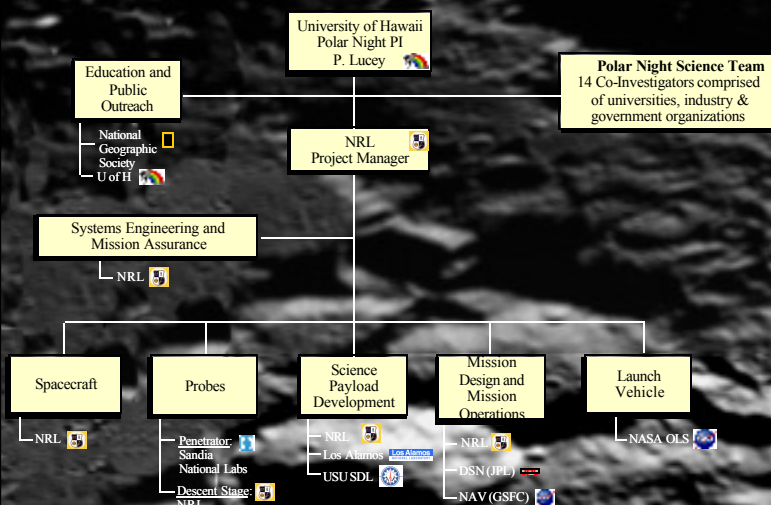
TECHNOLOGY OBJECTIVES

Polar Night is adapting existing technologies that have been developed for government or commercial applications to use for this mission and future civil missions.

Hardware	Heritage	Application
Penetrators	DoD dual use	Repackaged for science application
SAR	DoD dual use	Enhanced capability and science return
Mass Spectrometer	Commercial rugged, portable systems	Repackaged and ruggedized
Penetrator Neutron Spectrometers	Commercial Drilling Applications	Repackaged for science application

Application of Dual Use Technology

MISSION MANAGEMENT



EDUCATION AND PUBLIC OUTREACH

Polar Night's Education and Public Outreach (E/PO) program is designed to seize the imagination of students and the public. Polar Night intends to leverage the existing infrastructure of partner organizations: National Geographic Society and University of Hawaii to meet the following objectives:

- ★ Create an E/PO program that will inform and inspire students and the public by their active participation in the mission.
- ★ Develop engaging, hands-on standards-based educational materials and provide ready access to on-line materials already available.
- ★ Provide opportunities for classroom and on-line investigation in math, science, and technology education and expand the subjects covered to also include geography and social studies.

POINT OF CONTACT

For more information, contact Dr. Todd Mosher, Assistant Professor in the Mechanical and Aerospace Engineering department at Utah State University by calling (435) 797-2881 or via email at tjmosher@mae.usu.edu.

or contact Dr. Paul G. Lucey, Professor in the Hawaii Institute of Geophysics and Planetology, at the University of Hawaii at Manoa by calling (808) 956 3137 or via email at lucey@pgd.hawaii.edu.